

Alabama's Forests Through Time

by Jim Lacefield

an Early Devonian forest

the Coal Age

the Age of Dinosaurs

the Ice Age to Today

If you are like many Alabamians you probably love to get out into the woods and watch the forests as they change through the seasons. As you walk along you may wonder how these forests might have looked before European settlers first came to this land. What must they have been like when the first Native Americans arrived on their long, frigid trek from Asia ten thousand years ago? You might even pause to wonder what types of forests would have greened this land much farther back in time during the days when the dinosaurs ruled the Earth.

It happens that answers to questions such as these may be closer than you might think. Our best source of clues to the long-term history of Alabama's forests may be right under your feet, literally! This information is contained in a natural database much more ancient and lasting than any library or computer disk. It is recorded in the layers of sedimentary rock such as sandstone, shale, and limestone that lie spread beneath most of the state. Alabama's rocks preserve the fascinating history of change that has occurred in the state's landscape and life through the nearly unimaginable span of half a billion years. These rocks and the fossils they hold tell the epic tale of this land as it first arose from the sea and was inhabited through time by an ever-changing succession of plant and animal species.

Forests, like all other living communities on Earth, are shaped by the environments in which they occur. Alabama's rocks record a remarkable diversity of physical environments that have existed here — from warm oceans that covered the land for many millions of years — to ancient tropical forests and deserts — to cold, windswept grasslands during the Ice Age. Our forests of today are, in a very real sense, the product of all of the past forests, climates, and landscapes that have preceded them here through the ages.

Clues to the Earliest Forests

The first evidence of ocean life in Alabama comes from rocks of the Cambrian Period of Earth history more than 500 million years old, but it is not until layers deposited a hundred million years later during the Devonian Period that the first signs of terrestrial (land-dwelling) life begin to show up. Fossils of early land plants first appear in a set of shallow ocean rocks geologists call the Frog Mountain Sandstone. These rock strata from the northeastern part of the state contain fragmentary traces of primitive land plants that grew here about 380 million years ago. Thin layers of carbon that discolor the rock in spots are the remains of stems and primitive leaves swept out to sea and deposited in offshore sand bars that today are preserved as the Frog Mountain Sandstone.

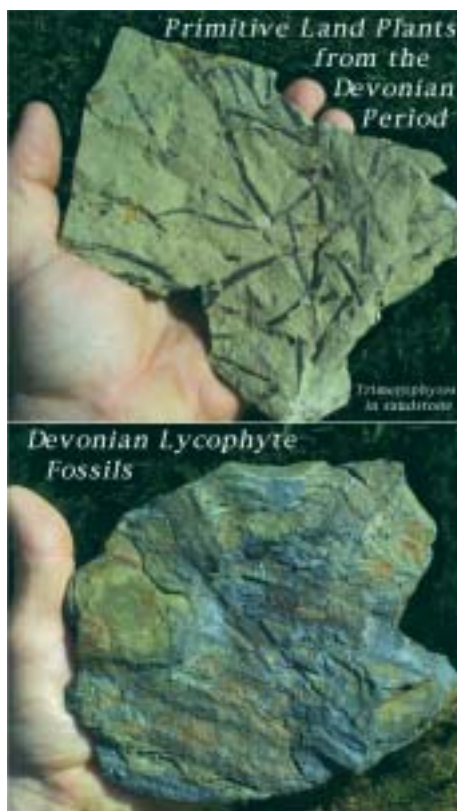
Fossils from other parts of the world indicate that the Earth's continents had first

been invaded by land plants during the previous phase of geologic time, the Silurian Period, at about the same time that Birmingham's Red Mountain iron ores were being deposited. These earliest land plants were spore-formers that had only primitive structures for moving water and food within their tissues. This inefficient arrangement of conducting tissue restricted them to small body size and to life in permanently wet habitats. By the Devonian Period, beginning slightly more than 400 million years ago, knee-high forests of these primitive plants had become well established on most of the Earth's continents. Near the end of the Devonian Period, sedimentary rock layers from the Alabama Piedmont called the Erin Shale contain the state's first primitive fossil plants that had attained tree-sized proportions.

The Hartselle Sandstone, a set of rocks from the next phase of geologic time — the Mississippian Period — contains the preserved remains of tree-sized lycopods and other primitive plant types that had gained a foothold on a shifting set of barrier islands that lay spread across what is now northern Alabama. Oddly enough, a variety of geologic clues suggest this land newly rising above the sea lay well south of the Earth's equator at the time. It might be hard for us to imagine a time so long ago when these earliest forests struggled to colonize this new land, but their story is written in stone in these ancient Alabama rock layers.

Alabama's Swamp Forests During the Age of Coal

Surprisingly, the ancient Alabama forests we probably know the most about grew here far back in time — over 300 million years ago — during the phase of the Earth's history geologists call the Pennsylvanian Period, or the "Coal Age." Our knowledge of these early forests is based on an extensive fossil record they left behind that continues to be uncovered



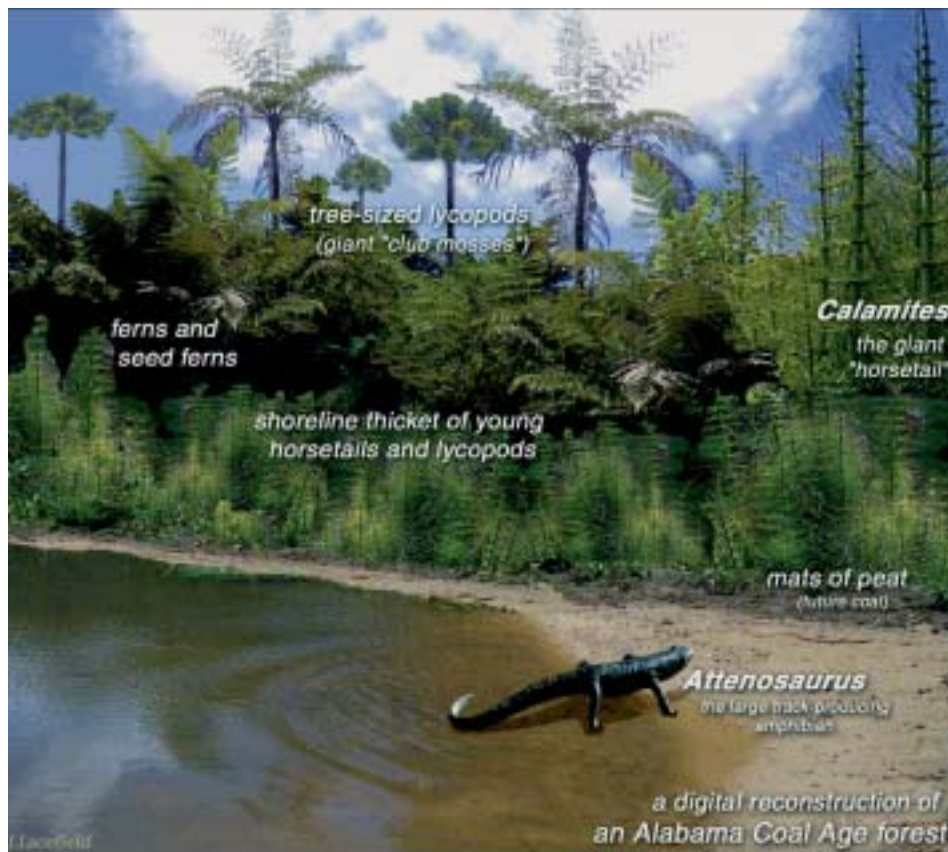
each day as their remains are mined in the form of coal. These abundant Coal Age fossils and the sedimentary rocks in which they are found provide clues to a fascinating “lost world” unlike any that has existed here in Alabama before or since.

It would be difficult to picture a more exotic landscape than the one found here during this part of the Earth’s history. Geological evidence shows that the continents were all in different positions from the present day, and the future land of Alabama lay in the sweltering tropics several degrees south of the equator at the time. Vast forests of lycopods — the primitive spore-forming trees related to today’s club mosses — towered above a broad coastal plain laced with many winding, sediment-filled rivers. Dragonflies with two-foot wingspreads darted beneath the sparse forest canopy and through a steamy under-story densely thicketed with giant horsetails and fern-like plants. Amphibians resembling an oversized version of today’s salamanders (such as the six-foot long *Attenosaurus* depicted in the Coal Age scene at the top of the page) left their human hand-sized footprints in mud flats near the water’s edge. These are found today alongside the wandering traces left by scavenging invertebrate creatures such as horseshoe crabs and millipedes.

Coal Age forests were unlike any on the Earth today in that all members of these prehistoric swamp communities have now been extinct for many millions of years. Many of the dominant “trees” of the time were gigantic members of primitive plant families whose only relatives today are tiny by comparison. The once-huge lycopods and horsetails whose remains make up most of Alabama’s coal grow only a foot or so tall in the present world. All members of another plant group known as seed ferns that dominated the coal forest under-story became extinct long before the age of the dinosaurs.



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The harsh tropical sun beats down upon an Alabama coal forest of 310 million years ago.

These strange Coal Age forest ecosystems resulted from special climatic, geographic, and biological conditions that were unique to that phase of the Earth’s history, but their reign was not to last. Profound changes were just beginning that would alter Alabama’s landscape even into our present day. The geologic forces of plate tectonics were in the process of shifting all of the Earth’s continents together into the ancient supercontinent geologists have named “Pangaea.” As part of this process, a landmass containing modern-day Africa and South America was being shoved northward into North America’s southern margin that included the future land of Alabama. As this southern supercontinent called “Gondwana” slowly crushed up against North America, the collision folded and uplifted the Earth’s crust to form the Appalachian Mountains. When this collision was finally complete by about 250 million years ago, all the Earth’s major landmasses were bound together in this single giant continent of Pangaea.

The future land of Alabama became locked within Pangaea’s dry interior, far from any moisture-producing ocean for more than a hundred million years. During this time the state was part of a

vast desert geologists believe was as dry and barren as modern-day Saudi Arabia. The lush tropical forests that had flourished here for so long vanished, leaving behind only their fossilized remains in the form of coal seams.

Alabama’s Forests During the Age of Dinosaurs

Following the trail of geologic clues to the development of Alabama’s forests onward in time, our next clear glimpse of the state’s prehistoric forests comes from rocks of the Cretaceous Period — the last

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A college geology student examines a fossilized trunk section of a huge Coal Age lycopod tree.

Alabama’s TREASURED Forests / 9

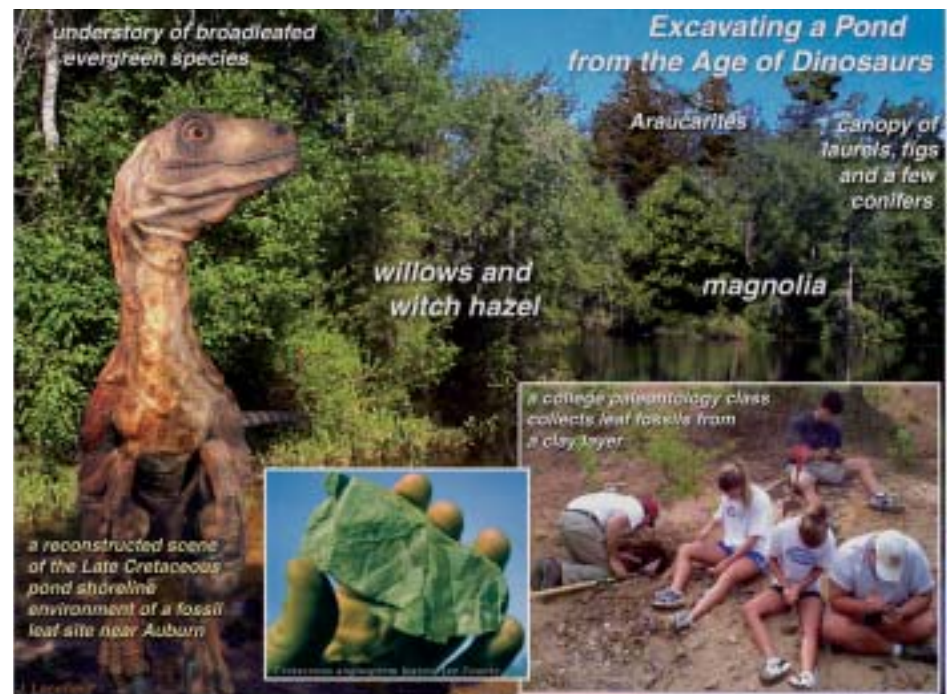
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part of the Age of Dinosaurs. Before this, however, there is a huge gap in Alabama's surface rocks, known to geologists as an unconformity that spans more than 200 million years. This gap separates the layers formed during the Coal Age from those that lie above them derived from this much later part of the Earth's history. These tell-tale "missing pages" of the geologic record are believed to represent roughly the length of time Alabama was uplifted and locked within the dry, mountainous terrain of Pangaea. Little new rock was deposited, and much of the land's surface was undoubtedly removed by erosion during this time. It was long thought that there might be no rocks left anywhere in the state that might provide information about this once-hidden part of the state's history.

Recently, tantalizing clues to these lost years of Alabama's past have been uncovered, but they come from rock layers now buried nearly five miles down beneath the southern part of the state. Deep drilling used to probe for natural gas resources has discovered unique sedimentary layers deposited in desert-like rift valleys that existed here as Pangaea first began to break apart during the Triassic Period, around 220 million years ago. As the continents rifted apart and the Gulf of Mexico first began to form, the land subsided and thick layers of sediment washed in from the north to bury these arid rift basins that date to the early days of the dinosaurs. On rare occasions fossilized bits of primitive plants called "cycads" that resembled small palm trees are brought to the surface in drilling cores extracted from these deep holes. Both these dry-adapted fossil plants and the unique sediments in which they are found suggest that even into the next part of dinosaur times known as the Jurassic Period, Alabama's climate was dry and the landscape probably only thinly vegetated. Again, it may be hard for us today to imagine a time when Alabama's environment and life were so different from the present day. These rocks buried so deep beneath South Alabama now supply a few of the key missing pieces to the strange puzzle that is the history of this land.

As the Gulf of Mexico basin first began to fill with ocean waters during the Jurassic Period around 190 million years ago, lush, tropical forests probably rede-



(Inset:) A college paleontology class collects fossilized leaves preserved in a dinosaur-age clay layer near Auburn. These leaves probably fell into a shallow, oxygen-poor coastal pond such as the one depicted in the reconstructed scene above.

veloped in Alabama in response to the new source of moisture. We don't have much information about these Jurassic forests or of the dinosaurs that must have walked them, because Alabama's rocks dating to this period lie deep underground and were deposited in ocean, not land, environments. Alabama's richest oil reservoir, the Smackover Formation, was formed on the floor of the young, expanding Gulf of Mexico during this time.

Geologic evidence of Alabama's forest history resumes again in rock layers deposited late in the Cretaceous Period, about 90 million years ago. Sea levels were very high, and a set of soft rocks geologists call the Tuscaloosa Group indicates that the state's coastline was far inland from the present one. The Gulf shoreline of the time ran from near Auburn in the east, to just north of the present-day cities of Montgomery and Tuscaloosa, then curved northward to slightly west of the Muscle Shoals area. Sediments of the Tuscaloosa Group are important in that they hold the first fossil leaves and petrified wood from a new plant group that would change the face of Alabama's forests forever. These new plants were the angiosperms, or flowering plants. During this part of Earth history flowering plants were spreading to be-

come the dominant plant group throughout the world. Today they include over 90 per cent of all living plant species.

As always, our knowledge of these Cretaceous Period forests comes from the types of plant fossils we find in rocks from the time. Fossils collected from the sedimentary layers of the Tuscaloosa Group include at least 187 species of fossil plants with 23 species of the cone-bearing gymnosperms, such as the cypress, and 152 species of flowering plants. Fossil leaves include ones from magnolias, laurels, figs, and *Araucarites*, a relative of today's Norfolk Island Pine.

Plant fossils also provide important clues to Alabama's climate during this period. A special type of fossil angiosperm wood known as *Paraphyllanthoxylon*, with living relatives found only in the Brazilian rain forest, helps biologists to conclude that the Late Cretaceous climate in Alabama was still tropical in nature, with adequate rainfall for thick forest development. This particular type of fossilized wood has almost no annual ring structure, suggesting very little seasonal differences in the climate. Another line of evidence to Alabama's Cretaceous Period climate has been derived from study of the percentage of this fossil flora that have entire (smooth) leaf margins.

Geologists studying past climates have been able to use this key characteristic of leaf structure to reconstruct the climate-related ecology of past forests with good success.

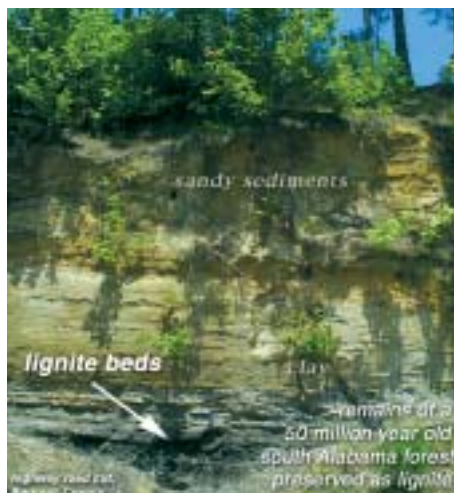
The Development of Alabama's Modern Forest Communities

Even after the days of the dinosaurs ended 65 million years ago in a sudden, catastrophic change in climate probably brought on by a large asteroid's impact with the Earth, evidence shows Alabama's forests continued to have tropical characteristics for millions of years. Dominant tree species as well as clues to the state's climate during this time frame that geologists call the Tertiary Period can be determined from fossils found in the rock layers from the time.

One special type of sedimentary deposit has been especially useful in providing clues to this portion of the state's history. These are the layers of lignite, or brown coal, found in east-west bands running parallel to the Tertiary Period coastline across south Alabama. Soft lignite coal is produced under similar environmental conditions to the much older coals formed during the Pennsylvanian Period, but they come from different plant species and result from different degrees of chemical change in the original plant material, called peat. These layers were never as deeply buried and therefore did not undergo as much chemical alteration.

Though these lignites will probably never have great economic value they contain important clues to the Alabama environment of about 50 million years ago. Plant fragments and fossilized pollen found in these lignites help to show the climate of coastal Alabama during this time. Oaks, hickories and walnuts, palms, tupelos, swamp cypress, water elms, and hollies are some of the broadleaf tree species preserved in the lignites. Conifer pollen includes that of cypress, dawn redwood, and a very few pine species that were just starting to make their appearance in Alabama forests. The presence of several tropical tree species suggests that the climate during this time was still warmer than that of the present, moist and with milder wintertime temperatures.

Alabama's forests had gained most of the tree families we find here today by the Miocene Epoch, about 20 million years ago. These forest communities would appear familiar to us even though the



individual species of these trees would continue to change. A global shift toward cooler climate that had begun about 35 million years ago had driven all of the tropical species southward, and deciduous trees such as oaks and hickories had become the dominant forest types.

A dramatic change in the world's climate beginning about two million years ago wrought far-reaching effects on Alabama's forest communities. The results of this climate change can still be seen in the composition of Alabama forests even today. This infamous natural event was the "Ice Age," also referred to as the Pleistocene Epoch of geologic history. Even though Alabama's landscape had largely reached its present form by this time the state's climate and life during the period were quite unlike today.

The Earth's Ice Age climate was much colder than average and glaciers up to two miles thick covered large areas of the northern continents. Massive ice sheets spread and then retreated many times over the last two million years. Glacial ice in North America advanced only as far south as the Ohio River Valley, and therefore, never came closer than several hundred miles to Alabama. Even this distance, though, was near enough to severely alter the state's biological communities. Huge Ice Age beasts such as mammoths, mastodons, giant bison, camels and ground sloths roamed the forests and grasslands of Ice Age Alabama. At times sea levels were so low due to the volume of the Earth's water locked up in the ice-caps that these animals could have grazed 60 miles south of Alabama's present coastline out onto the continental shelf.

Information on Alabama's Ice Age forests has come from several unusual sources. Among the most informative of

these has been the study of fossil pollen grains contained in core samples from special, undisturbed environments such as upland bogs and sinkholes. These pollen samples along with others from the eastern United States show that as glaciers advanced southward, vegetation zones shifted south with them. North Alabama then lay in a transition zone of northern hardwoods and evergreens such as hemlock and spruce similar to that found in southern Canada today. To the south were open forests of drought-tolerant trees interspersed with prairie-like grasslands. These studies suggest that this climatic disruption lasted until so recently that Alabama forests may still be in the process of recovering from the Ice Age, with many tree species slowly migrating back northward through the forests even into the present day.

Each glacial period was separated by brief, warm interglacial periods. Many scientists believe we may still be in the Ice Age and that glaciers will one day return. Our current interglacial period, called the Holocene Epoch, has lasted approximately 10,000 years. All of human civilization, written language, agriculture, and technology above the level of stone tools has come about in this geologically brief span of time.

From this thumbnail sketch of the history of Alabama forests it is easy to see that many factors have molded this land and its life through the ages. However, one new force today shapes our forests more than all others. Since humans first arrived here, man has been the most important force in forest change. The care we exercise in managing our forests will determine in large part our future quality of life and success in this land. ♣

